

Chapter III: Selection of Recommended Indicators

A. Overview

Environmental health indicators and benchmarks can be used as tools for a variety of purposes. From a strictly human rights perspective, an important application of environmental health indicators and benchmarks is identifying and holding accountable entities, organizations and/or individuals most responsible for causing or allowing various adverse impacts of harmful environmental agents on human populations. For these reasons, environmental health indicators and benchmarks are essential tools for highlighting critical policy issues in the public health sector that have been previously neglected or given low priority by elected officials or regulatory agencies in a country, region or community. Human rights-based environmental health indicators and benchmarks provide channels for monitoring and information-gathering, which allow the public means to assess different policy options that are open for consideration by local regulatory officials and other national and international decision-makers. Although such indicators and benchmarks by themselves are not capable of identifying underlying societal issues related to environmental impacts on human health, they can be used as means to raise awareness about critical environmental problems in a community. In other words, they can be used as effective tools by both members of the general public and policy makers to target significant problems of environmental health where priority action are most needed.

B. Definitions of Environmental Health Indicators and Benchmarks

As defined and used in this manual, an environmental health indicator is a quantitative measure that assesses the impact of an environmental agent on the health and well-being of an adult or child living in a community. For example, the ambient concentrations of harmful agents can be chosen as an environmental health indicator, such as concentration levels of air or water pollutants for which national and/or regional regulatory standards have been officially adopted or for which international recommended guidelines have been issued. Similarly, the percentage of individuals in a community suffering from diseases that are directly related to exposure to environmental agents can be used as an environmental health indicator. For example, in a specific region the incidence of children below the age of five with diarrrheal diseases, which are caused by identifiable sources of contaminated water, can serve as an indicator of infant and early childhood health in a community.

On the other hand, environmental health benchmarks as defined in this manual are quantitatively designated goals that are formally established by legislation and/or regulation or are informally agreed upon by process of consultation among public health experts, policy makers and members of the community. Generally speaking, environmental benchmarks are often developed within a specific time-frame in a given country or region. To illustrate this, consider an environmental benchmark to phase-out the marketing and sale of leaded gasoline in a region over a five-year period. Such an environmental benchmark could be established as a matter of public policy in order to eliminate childhood neurological damage caused by harmful emissions of airborne lead in automobile exhausts in many congested urban areas. As such, in some regions it may be preferable and economically more efficient to set agreed upon environmental benchmarks rather than collecting difficult-to-obtain data on exposure-based environmental indicators as a means to determine desired public health goals.

C. Human Rights Perspective: Public Policy Factors

When employing environmental health indicators and benchmarks from a human rights perspective, several policy-related and practical factors should be kept in mind³:

- **Policy Relevant.** Indicators and benchmarks should measure environmental health factors that have the potential to be addressed either directly or indirectly by adoption of public policy.
- **Accessible.** Data on indicators and benchmarks should be accessible to all segments of society—different people should be able to use them and get the same results.
- **Understandable.** Information on indicators and benchmarks should be formulated in such a way that all members of the public and policy makers can understand and follow them.

3 United Nations Development Program (UNDP). 2000. *Using Indicators for Human Rights Accountability. Human Development Report.* Available from Website: (<http://www.undp.org/hdr2000/english/book/ch5.pdf>)

- **Consistent.** Indicators and benchmarks should remain consistent over time in order to ensure that agreed upon goals are being met, and for evaluating whether progress is being made over a specific period of time.
- **Disaggregable.** To the extent it is practicable, indicators and benchmarks should be designed so as to disaggregate data to focus specifically on young children, women and other vulnerable groups, including minority and underserved members of a community.
- **Impartiality.** Monitoring data on indicators and benchmarks should also be evaluated by independent and technically competent professionals associated non-governmental organizations and/or academic institutions in order to avoid any real or perceived conflicts of interest by government officials associated with monitoring bodies or regulatory agencies.

D. Screening Process and Applications

As discussed earlier, the tabular spreadsheet listing existing environmental indicators and benchmarks from international and national agencies and organizations is quite voluminous (over 500 separate indicators) that differ in their ability to determine public health impacts from a human rights perspective. For these reasons the first step in the selection process involves developing suitable screening criteria for selecting the most relevant environmental health indicators and benchmarks, and for developing a set of performance-based indices, based primarily on human rights considerations. A number of criteria developed in this manual reflect such an approach, and they were weighted according to their relevance in monitoring public health in the community.

Each of the five criteria listed below is weighted with a number ranging from 0.5–1.5 signifying its level of importance with respect to human rights relevance. For instance, criterion (II) received a higher weighting factor (1.5) than the other selection factors since it highlights the environmental health impacts on children and other vulnerable groups. The selection criteria, along with the reasons for choosing them, are given as follows:

- I) Does the indicator or benchmark measure the environmental impacts on human health of the general population? *Weight: 0.5*
 - Are the environmental impacts on human health clearly established?
 - This criterion was weighted with a score of “0.5” because it highlights the status quo of the general population and not the vulnerable members of the community.
- II) Does the indicator or benchmark measure or highlight the impacts on children and other vulnerable groups? *Weight: 1.5*
 - To reflect an explicitly human rights criterion, the environmental impacts of the most vulnerable groups are given the highest weighting.
 - The impact on children’s health is of particular importance. Infant’s and young children’s bodily functions and immune systems are constantly developing, and are thus more prone to serious impacts from harmful environmental agents than adults. Measuring environmental health in children not only highlights the impact of a particularly vulnerable group, it provides evidence of the impact of a polluted environment on future generations.
 - This criterion promotes the need for disaggregation of vulnerable populations.
- III) Can the indicator or benchmark be linked to the source of environmental health problem? *Weight: 1.0*
 - It is important that indicators and benchmarks are developed where the environmental source can be properly identified. Without being able to identify an environmentally harmful source, performance-based indicators are meaningless in terms of remedying the public health problem. For instance, an indicator such as “infant mortality rate” serves only to draw attention to a broad societal and public health problem; such an indicator does not reflect the complexities attributed to infant mortality, since there are many causes contributing to this problem.
 - This criterion promotes policy relevance, disaggregation, accessibility, impartiality of monitor, and the need for consistent monitoring over time.
- IV) Can the indicator or benchmark be applied (addressed/enforced/monitored) by regulatory agencies and other government institutions? *Weight: 1.0*
 - If an indicator or benchmark cannot be applied within a regulatory or legal context, it cannot be used as a performance-based indicator that measures the capability of a government agency to meets its regulatory responsibilities.

- This criterion seeks to determine whether an indicator or benchmark can be used to provide performance measurements of regularity agencies over specific time periods.
- V) Does the indicator help to determine institutional gaps in achieving already established national regulatory standards and/or international guidelines? *Weight: 1.0*
- This criterion assesses whether established national regulatory standards and international guidelines that measure human health impacts of contaminated environments, such as those adopted by United States EPA or WHO, can serve as a suitable benchmark when a country has not developed its own national environmental health standards (i.e. air/water quality/toxic substances, etc).

Application of Selection Criteria

Each item from the collated list of 500 existing indicators and benchmarks was analyzed applying the above mentioned criteria and given an individual score number, wherever possible (See Table). If an indicator met the requirements of criteria (I), (II), and (III), but not (IV) and (V), it was given a weight of “3.” If the indicator fulfilled the requirements of criteria of (II) and (III) only, it was given a weight of “2.5,” and so on. The following examples illustrate how the screening process using the given criteria was applied:

Illustrative Examples:

Indicator #1: “Percent of population with access to adequate sanitation services (urban and rural)”

Source: UNICEF

- Does the indicator measure the indirect/direct impact on human health of the general population? This indicator does measure a potential impact on the general population’s health. Without access to adequate services of sewerage, many waterborne diseases are easily spread. (Score: 0.5).
- Does the indicator measure or highlight the impacts on children and other vulnerable groups? No. This indicator only measures the potential impact on the general population, because it does not disaggregate to specify where access to adequate sanitation services is lacking, and who is affected. (Score: 0)
- Can the source of the problem/issue be identified? Yes. The source of the problem is lack to adequate sanitation facilities. (Score: 1).
- Can the indicator be applied (addressed/enforced/monitored) by regulatory agencies or other institutions? Yes. Governments should be able to collect data on whether or not their sanitation infrastructures are functioning properly, and locate areas where they do not exist at all (Score: 1).
- Does the indicator signify a gap in achieving already established national regulatory and/or international guidelines? Countries that have established benchmarks for developing sanitation services in the community would receive a score of 1 for this criterion. (Score: 0 or 1).

Overall Weight: 2.5 or 3.5

Indicator #2: “Annual Withdrawals of Ground and Surface Water”

Source: UN Statistics Division

- Does the indicator measure the indirect/direct impact on human health of the general population? This indicator does not measure any potential impact on the general population because the health effect of the environmental condition is not apparent. (Score: 0).
- Does the indicator measure or highlight the impacts on children and other vulnerable groups? Since the indicator does not measure and impact on the general population at all, it cannot measure impacts on children and other vulnerable groups. (Score: 0)
- Can the source of the problem/issue be identified? This indicator would not differentiate between water extracted for sanitation and drinking purposes and that related to agricultural and/or industrial consumption. It merely tells us that people are using more water than is available in supplies of surface and groundwater. (Score: 0).
- Can the indicator be applied (addressed/enforced/monitored) by regulatory agencies or other institutions? Since it is not clear whom or what is responsible for the annual withdrawals of ground and surface water, there is no one and nothing to regulate. (Score: 0).
- Does the Indicator signify a gap in achieving already established national regulatory and/or international

guidelines? Most countries have rules and regulations governing how much surface and groundwater may be extracted, and by whom. (Score: 1).

Overall Weight: 1.0

After every indicator had been weighted satisfactorily according scale of the five indicator selection criteria, only the indicators which had scored at a level of “3.5” or above were set aside for serious consideration. A closer inspection of the over 70 indicators which remained led to some interesting observations. First, there appeared to be two types of indicators: those that identified the source of a problem, and those that identified a symptom. These were categorized into preventative and remedial indicators, respectively (see discussion below). Secondly, both preventative and remedial indicators varied according to availability of data. To express the variety of data available among indicators and benchmarks, they were thus grouped into one of three categories: primary, secondary, or tertiary (see below).

E. Preventative and Remedial Indicators

As mentioned above, once the initial selected indicators or benchmark had been drawn out of the pool of 500 using the above-mentioned criteria, a pattern of two types of indicators began to emerge: preventative and remedial. The “type” categorization used followed the “DPSEEA framework” developed by David Briggs that had previously been prepared for the World Health Organization.⁴ The acronym “DPSEEA” represents six categories of markers or activities: (1) Driving Force, (2) Pressure, (3) State, (4) Exposure, (5) Effect, and (6) Action. Most indicators or benchmarks listed under the DPSEEA scheme that fall under driving force (**D**) or pressure (**P**) categories are bellwether or “warning” signs in that they foresee adverse health consequences that result from environmental impacts before the effects are manifested. These were categorized as preventative indicators, which implies that if the public health issues that are identified were adequately addressed, their anticipated adverse health outcomes could be prevented. On the other hand, those listed as state (**S**), exposure (**E**), and effect (**E**) types signify current health risks whose environmental impacts are not adequately addressed, and therefore categorized as remedial indicators.

In other words, preventative indicators are those that identify the sources of the problem, while remedial indicators are those that address the symptoms of the problem. For example, in developing an indicator for water and sanitation services, we have: (i) a preventative indicator that measures “percentage of population in the community with access to adequate services of sewerage”, and (ii) a remedial indicator that gathers environmental health data on the “annual incidence of diarrhea morbidity in children below the age of five.” From a human rights perspective, these two indicators complement each other—they illustrate both the necessity to prevent the causes of environmental stress and to seek remedial means to address human disease symptoms. In terms of follow-up action (**A**) in formulating public health policies and regulatory priorities, these indicators suggest the importance of focusing resources to provide clean water and sanitation services in the community to prevent or reduce cases of childhood diarrhea morbidity and mortality in the long run, while at the same time assuring that the plight of children currently suffering from water-borne diseases in the short run is given proper medical attention by the community.

F. Primary, Secondary & Tertiary Indicators and Benchmarks—Availability of Data and Modifying Factors

A common difficulty in developing performance-based indicators and benchmarks is the lack of availability of environmental monitoring or public health data gathered by national or regional regulatory agencies. This is especially true in many developing countries, where because of lack of financial and technical resources and severe personnel constraints, it is often difficult to collect monitoring data to assess the severity of environmental health problems. For these reasons, environmental health indicators and benchmarks recommended in this manual have been organized into three separate categories—primary, secondary and tertiary – that allows for determining data collection priorities, while providing flexibility in the development of appropriate environmental health indicators and benchmarks. The overall categorization scheme is based on the ready availability, cost-effectiveness and overall practicality of the recommended indicators or benchmarks:

- **Primary Indicators.** Primary indicators and benchmarks are those that are more or less readily available, since the collection and storage of their databases are generally carried out by national regulatory agencies and/or by regional or international monitoring bodies. Primary indicators are based

⁴ Briggs, David. (1999). *Environmental Health Indicators: Framework and Methodologies*. Geneva: Nene Centre for Research, University College Northampton, WHO. Available online at: http://www.who.int/environmental_information/Information_resources/documents/Indicators/EHIndicators.pdf

on data that is presently being collected by national and local governments, usually in accordance with duly enacted regulatory standards/guidelines or other legal requirements. In addition, these indicators and benchmarks may be formulated into performance-based regulatory indices by direct comparison to applicable international/national standards and guidelines or socially accepted norms and timetables.

Example: Safety of Public Water Drinking Supply: Enteric Bacterial Contamination. A number of regulatory agencies, both at the national and local levels, routinely monitor the presence of enteric or coliform bacteria in drinking water supplies, based on nationally adopted standards or based on WHO's safe drinking water guidelines. In such cases, the use of this widely available primary indicator of the health risks of local sources of potable water should not be too difficult to delineate and implement.

- **Secondary Indicators.** Generally speaking, national or local government agencies may not invest significant resources in the collection of environmental or public health data if no regulatory standards or guidelines regarding a specific environmental problem exist. Thus, an indicator or benchmark may be placed in a secondary category if: (a) there is a lack of legislative or regulatory priority in developing environmental health standards or guidelines, or (b) cost-effective or practical data collection strategies are not available at the present time in certain regions of the world. In such cases, monitoring data on secondary indicators could only be collected if more technical and financial resources are mobilized to address environmental problems at the national or local levels. On the other hand, secondary indicators as defined here could also be formulated as reasonably reliable surrogate or indirect measurements of environmental health risks, especially when it is not practical or cost-effective to collect monitoring data for primary indicators or benchmarks.

Example: Percent of Automobile Fleet with Catalytic Converters. At present, the use of catalytic converters for tailpipe control of nitrogen dioxide emissions in automobiles is not a widely enforceable legal requirement in many developing regions. However, such air pollution regulatory requirements are increasingly being adopted or considered in a number of developing countries. Thus, the determination of the proportion of automobile fleet that are fitted with catalytic converters may be deemed to be a fairly accurate surrogate environmental health indicator or benchmark for assessing or setting goals on the air pollution health risks of nitrogen dioxide exposures to inhabitants residing in cities and surrounding regions.

- **Tertiary.** Tertiary indicators are those risk assessment tools that could be used to identify significant environmental health problems, where presently little or no data are currently being collected. In some instances, tertiary indicators as defined here have yet to be developed and evaluated before they can be utilized effectively. The chief difference between secondary and tertiary indicators or benchmarks is that the former could be implemented once national or local regulatory standards or guidelines are adopted and technical/financial resources become available.

One additional complementary item in utilizing environmental health indicators and benchmarks are the use of modifying factors and baseline data. These considerations are not intended to be incorporated in the development of indicators or benchmarks as such, but rather can be seen as auxiliary factors that should be taken into consideration when determining selection priorities and in interpreting information derived from primary, secondary or tertiary environmental indicators and benchmarks.

- **Modifying factors.** The identification of modifying factors that are present in a region may help guide the selection of environmental health indicators or benchmarks. This is because modifying factors, such as the nature of geographic terrain, prevailing weather conditions, human population densities, prevalence of commercial and industrial units, etc, would provide either more or less weight in the selection of an indicator or benchmark than would otherwise be the case. For example, the modifying factor of "geographic location and climate type" can exacerbate the effects of the air pollution from exposure to nitrogen oxides or ozone. This is especially true if the region being considered lies within a closed mountainous terrain that lies within a subtropical climate regime, such as Southern California or the Mexico City metropolitan region. On the other hand, if the region in question lies within the flat and drier plains of North America's midwest temperate climate, the modifying factor would be of lesser consequence in exacerbating the effects of air pollution.

G. Environmental Health Performance-Based Indices

Regulatory action to address environmental health concerns rests primarily on the performance of national or local governments, and thus, performance-based indices under any proposed environmental health indicators project should be structured around this concept. For these reasons, environmental health performance-based indices are devices that can be used to compare current environmental health monitoring data to generally accepted international and/or national regulatory norms, standards and guidelines.

For example, an air quality monitoring program of a country may possess extensive atmospheric ambient concentration data for annual averages of sulfur oxides and nitrogen oxides that could be compared against WHO's recommended air quality guidelines or the legally established national air quality standards. Thus, an air quality performance-based index could be established defined as follows: the numerical ratio of the air concentration levels of a given air pollutant divided by its established international air quality guideline or national regulatory standard. For example, if air concentration levels of sulfur oxides in a given region frequently exceeds WHO's air quality guidelines for the air pollutant—say by over two or three fold—then the sulfur oxides air quality performance-based indices (such as 2.6 or 3.1) may be used as a highly transparent and practical tool for decision makers in setting priorities for achieving environmental and public health goals in the community. Similarly, other environmental health performance-based indices may be used to compare public health trends, both spatially and temporally, i.e., between different urban and/or rural areas, or to monitor monthly or yearly progress in meeting regulatory standards or agreed upon benchmarks. Above all, environmental health performance-based indices are simple to understand and interpret. Thus, members of the public and policy making community alike can employ them for taking short term preventative and remedial actions, and for establishing long term public policy goals and objectives.